REMARKS/ARGUMENTS

Claims 1, 8, 9, 10, 17-20, and 24 are amended, claim 25 is canceled, and new claims 27-28 are added herein. With entry of this amendment, claims 1, 5-10, and 14-24, and 26-28 will be pending.

The courteous telephone interview granted applicants' undersigned attorney by Examiner Huy Ho on August 10, 2009 is hereby respectfully acknowledged. The arguments presented in the interview are set forth below.

Claims 1, 5-10, and 14-24, and 26 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,965,942 (Young et al.) and further in view of U.S. Patent No. 6,674,730 (Moerder) and further in view of U.S. Patent No. 7,006,534 (Nemoto).

Claim 1 is directed to a method for operating a point-to-multipoint wireless communication network. The method includes measuring link delays between a root bridge and a plurality of non-root bridges, calculating a common time slot value based on the measured link delays, distributing the measured link delays and the common time slot value within the point-to-multipoint wireless communication network, and aligning contention timing boundaries based on the measured link delays and the common time slot values. The contention timing boundaries coordinates transmissions and reduces the probability of collision in a carrier-sense multiple access with collision avoidance scheme. Claim 1 has been amended to clarify that the common time slot value is calculated based on a longest measured link delay and that that aligning contention timing boundaries includes adjusting a network allocation vector.

Young et al. describe a system for improving throughput over WLANs with mode switching. The system sets a contention window value that is lower than that set by the IEEE 802.11 standard. Factors considered in determining the load and establishing the contention window include number of transmissions, number of receptions, and number of collisions.

Young et al. do not measure link delays between a root bridge and non-root bridges or use measured link delays to coordinate transmissions. In rejecting the claims, the Examiner refers, for example, to claim 1 (col. 10, lines 45-67). Claim 1 of Young et al. describes measuring a load of traffic and includes determining a number of transmissions, and number of collisions. These measurements are performed to determine the overall load conditions of the network, rather than specific condition (such as link delay) between two points in the network. Thus, Young et al. do not measure link delays. The Examiner also notes this at line 3 of Page 4 of the Office Action dated September 29, 2008.

Furthermore, Young et al. do not use link delays or any type of measurement to coordinate transmissions. Young et al. use load conditions to establish a contention window, which is used to determine a backoff period (delay). Young et al. improve throughput by reducing the contention window, and thus the delay. As described at col. 6, lines 50 - col. 7, line 4 of Young et al., systems operating in accordance with IEEE 802.11 select a random delay from a contention window that begins with an initial value or number of slots. For each subsequent collision event, the contention window size is approximately doubled. Young et al. set a minimum value for the initial contention window that is lower than used in the 802.11 standard, and each subsequent window increases at a slower exponential rate than the standard systems. Thus, it is only the size of the contention window that is adjusted in Young et al.

In contrast to Young et al., applicants' invention uses a measurement to coordinate transmissions by aligning contention timing boundaries including a time slot value and network allocation vector. As set forth in 802.11, a network allocation vector (NAV) timer is set after transmittal of the RTS and CTS frames. The NAV timer counts down from its initialization value to zero. After expiration of this time, there is a backoff time before a node can transmit. The backoff time is computed as the product of a locally computed random number and a system time slot. The random number generation is distributed between 0 and a contention window value. It is this contention window value that Young et al. reduce to increase system throughput. Young et al. do not discuss modifying the system time slot value or the network allocation vector.

Moreover, the coordinated transmissions between the root bridge and plurality of non-root bridges in the claimed invention reduce the probability of collisions. The measured link delays are used to align contention time boundaries and modify system time slot to reduce packet collision probability and therefore improve overall system throughput. Applicants' invention improves throughput by coordinating transmissions based on the measured link delay, whereas Young et al. improve throughput by reducing delay. The reduction in contention window in Young et al. clearly increases the probability of collision. Young et al. specifically monitor the number of collisions for situations where the number of collisions are increased due to the reduction in window size. In the Response to Arguments the Examiner refers to the calculation of a collision ratio in Young et al. This ratio is calculated to determine if the contention window can be reduced according to the object of the invention. When the contention window is reduced, the number of collisions are likely to increase. If the collisions increase above a specified amount, the contention window can no longer be reduced.

Conventional CSMA/CA operation as disclosed in Young et al. provides no shared understanding of system timing, thus, there is a much higher probability of collisions due to breakdown of the MAC layer collision avoidance mechanism. For example, when a new packet RTS or CTS is heard, the NAV time is set based on this duration field. Until this timer expires, the medium is considered to be busy. Expiration of a prospective transmitter's NAV timer may not be a realistic indication of medium availability from the perspective of the intended receiver. At the conclusion of the busy period, a transmitter that begins a transmission right at the beginning of a slot may potentially collide with other transmitters that are beginning transmission on that slot or some portion of the previous slot due to the varying understanding of the slot boundaries and delayed detection of simultaneous transmissions due to link propagation delays. As link distances increase, packet collision probabilities will also increase unless timing boundaries are well understood at all stations.

Furthermore, conventional physical layer carrier sense mechanisms may not be helpful in a wireless campus network due to a hidden terminal problem. Thus, much larger

collision probabilities can be expected when conventional 802.11 techniques are extended to campus-scale wireless networks. The claimed invention adapts 802.11 techniques to networks with larger propagation delays, such as campus point-to multipoint wireless networks. Applicants' invention is particularly advantageous in that aligning contention timing boundaries and modifying the system time slot based on measured link delays is very effective in reducing packet collision probability.

The Moerder patent is directed to a method and apparatus for time synchronization in a communication system. In order to synchronize remote units to a common time, a hub station periodically sends a timing indication. When the remote unit receives a time indication from the hub station, it sets the transmission clock equal to the time indication advanced by the determined transmission delay. A time offset between the time of receipt of a time tag transmission and a predetermined absolute time indicates an error in estimating a forward link delay associated with forward link channels as perceived by the remote unit. In contrast to the claimed invention, in which CSMA is implemented, Moerder uses CDMA, which does not defer transmissions or use a contention window or timing boundaries.

The invention defined by claim 1 specifically requires the use of measured link delays to coordinate transmissions in a CSMA/CA scheme. As described above, Young et al. use load conditions to determine if they can reduce a backoff period, and thereby improve throughput. A timing indication used by Moerder would not help Young et al. determine load conditions, and therefore would not be used to establish a new backoff period.

Moreover, Moerder does not distribute measured link delays to non-root bridges. Measurements in Moerder are made and used at a remote unit, thus there is no distribution of any link delays.

As noted by the Examiner, neither Young et al. nor Moerder show a common time slot.

Nemoto discloses a radio communication system which permits expansion of the coverage of a radio base station to ensure efficient communications. The system is configured to continuously allocate time slots in a frame to generate a continuous time slot. Nemoto does not show or suggest calculating a common time slot value based on measured link delays. In contrast to the claimed invention, Nemoto calculates transmission timing for a signal to be transmitted from a terminal unit to a radio base station. This transmission time is not a common transmission time. The calculation is performed during the period of a continuous time slot. The continuous time slot is a combination of one control time slot and expanded guard bits and corresponds to two time slots. It is used for a transmission between a radio base station and terminal unit. Thus, the continuous time slot does not need to be calculated and is not a value that would be distributed within a network.

Without the modifications provided by the claimed invention, it can be seen that throughput is severely impacted by collisions in IEEE 802.11 point-to-multipoint wireless bridge systems (see, e.g., pages 18-21 and related Figures in the specification). Aligning contention timing boundaries and modifying system slot time based on measured link delays is very effective in reducing packet collision probability and thus improving overall system throughput.

Accordingly, claims 1, 8, 9, 10, 17, 18, 19, and 20, and the claims depending therefrom, are submitted as patentable over the cited references.

With regard to claim 5, Moerder uses a timing indication signal that is received by a remote unit. It is the remote unit that monitors a signal from the hub to determine when to synchronize. The hub does not perform any measurements.

Claim 7 is further submitted as patentable because none of the cited reference teaches giving access preference to more distant non-root bridges.

Claim 21 specifies that coordinating transmissions comprises adjusting a network allocation vector time. As discussed above, Young et al. establish a new contention

window value. None of the cited references show or suggest using any factor to adjust a network allocation vector time to coordinate transmissions in a CSMA/CA scheme.

With regard to claim 22, the Examiner has failed to point to any teaching of receiving a disassociation request, deleting a non-root bridge from a list, updating a common time slot value, and distributing an updated time slot value to non-root bridges. As noted by the Examiner neither Young nor Moerder teach a common time slot. In rejecting the claims, the Examiner refers to cols. 8 and 9 of Young et al., which describes how to calculate an initial contention window. The other sections cited describe conventional 802.11 communications.

With regard to claims 23-24, the Examiner cites Young et al. which do not measure link delays. Each of the claims includes limitations directed specifically to link delays.

Claim 26 is further submitted as patentable over the cited references which do not show or suggest a MAC layer processor configured to set a network allocation vector of each set of multiple access collision avoidance packets.

For the foregoing reasons, Applicants believe that all of the pending claims are in condition for allowance and should be passed to issue. If the Examiner feels that a telephone conference would in any way expedite prosecution of the application, please do not hesitate to call the undersigned at (408) 399-5608.

Respectfully submitted,

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